DIGITAL COMMUNICATIONS

V Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB20	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. The building blocks of digital communication systems such as source coding channel coding, modulation techniques.
II. Encoding of digital data streams encountered in multimedia communications and data storage devices.
III. The applications of spread spectrum techniques in secured digital communication systems.
IV. Analyse error performance of digital communication system in the presence of noise and other interferences
V. The applications of spread spectrum techniques in secured digital communication systems.

COURSE OUTCOMES:

After successful completion of the course, Students will be able to:

CO 1 **Recall** the concept of communication and conventional digital communication systems for signals analysis.
CO 2 **Illustrate** the concept of pulse code modulation, demodulation, sampling, quantization and coding for obtaining of digital data.
CO 3 **Compare** the basic functions of pulse amplitude modulation (PAM), pulse position modulation (PPM) and pulse width modulation (PWM) to differentiate pulse modulation schemes.
CO 4 **Analyze** digital pass band communication schemes (ASK, PSK, FSK) using modulation and demodulation process.
CO 5 **Distinguish** Pulse modulation schemes with their advantages, disadvantages and Applications using encoded data.
CO 6 **Solve** for the bandwidth, error probability of different base band and pass band modulation techniques, in terms of signal space diagrams, bit duration and bit energy.
CO 7 **Demonstrates** the Unipolar, bipolar signals using binary and multilevel line coding methods.
CO 8 **Illustrate** the pulse shaping of line codes to mitigate inter symbol interference, cross talk using optimum filter, Raised cosine filters.
CO 9 **Outline** the information theory, source coding techniques for calculating Entropy of source
CO 10 **Compare** various spread spectrum techniques in terms of frequency hopping.
CO 11 **Build** the block codes, Convolutional codes, encoding and decoding using time domain, transform domain and graphical approaches.
CO 12 **Interpret** the performance of different error control schemes for the reliable transmission of digital data using systematic and non systematic codes.
CO 13 **Examine the time and frequency domain analysis of the signals in a digital communication system.**

MODULE -I	PULSE DIGITAL MODULATION	Classes: 10
Pulse Modulation: Analog pulse modulation, Types of pulse modulation; PAM (Single polarity, double polarity); Generation & demodulation of PWM; Generation and demodulation of PPM; Introduction: Elements of digital communication systems, advantages and disadvantages of digital communication systems, applications; Pulse Digital Modulation: Elements of PCM; Sampling, quantization and coding; Quantization error, non-uniform quantization and companding; Differential PCM (DPCM);Adaptive DPCM; Delta modulation and its drawbacks; Adaptive delta modulation; Comparison of PCM and DM systems; Noise in PCM and DM systems.		
MODULE -II	**DIGITAL MODULATION TECHNIQUES**	**Classes: 08**
Digital Modulation Techniques**:** Introduction, ASK modulator, coherent ASK detector, non-coherent ASK detector, FSK, bandwidth and frequency spectrum of FSK, non-coherent FSK detector, coherent FSK detector; BPSK, coherent BPSK detection; QPSK; DPSK, DEPSK; Optimal reception of digital signal**:** Baseband signal receiver; Probability of error; Optimum filter; matched filter, probability of error using matched filter; Correlation receiver; Calculation of probability of error for ASK, FSK, BPSK.		
MODULE -III	**BASE BAND TRANSMISSION AND PULSE SHAPING**	**Classes: 10**
Base Band Transmission: Requirements of a line encoding format, Various line encoding formats: Unipolar, Polar, Bipolar; computation of power spectral densities of various line encoding formats. Scrambling techniques: BZ8S, HDB3. **Pulse Shaping**: Inter symbol interference; pulse shaping to reduce ISI; Nyquist's criterion; Raised cosine filter; Equalization; Correlative level coding; Duo-binary encoding, modified duo –binary coding; Eye diagrams; Cross Talk.		
MODULE -IV	**INFORMATION THEORY AND SOURCE CODING**	**Classes: 09**
Information Theory: Information, entropy, conditional entropy; Mutual information; Channel capacity; Various mathematical modeling of communication channels and their capacities; Source coding: Fixed length and variable length Source Coding Schemes, Huffman coding; Shannon fano coding, Source coding to increase average information per bit; Lossy source coding; Channel coding theorem; Hartley Shannon law; Tradeoff between bandwidth and S/N ratio; Spread spectrum modulation: Use of spread spectrum; Direct sequence spread spectrum (DSSS); Code division multi pleaccessusing DSSS, frequency hopping spread spectrum; PN-Sequences: Generation and characteristics; Synchronization in spread spectrum systems.		
MODULE -V	**LINEAR BLOCK CODES AND CONVOLUTION CODES**	**Classes: 08**
Linear Block Codes: Introduction to error control coding; Matrix description of linear block codes, error detection and error correction capabilities of linear block codes; Hamming code; Binary cyclic codes algebraic structure, encoding, syndrome calculation and decoding; Convolution Codes: Introduction, Encoding of convolution codes; Time Domain Approach; Transform Domain Approach; General approach; State, Tree And Trellis Diagram; Decoding using Viterbi Algorithm; Burst Error Correction: Block Inter leaving and convolution interleaving.		

Text Books:

1. Herbert Taub, Donald L. Schilling , "Principles of Communication Systems", TMH, 3rd edition, 2008
2. K. Sam Shanmugam, "Digital and Analog Communication Systems", John Wiley & Sons, 2nd Edition, 2005.
3. Simon Haykin, "Digital communications", John Wiley, 3rd Edition, 2005.

Reference Books:

1. John Proakis, "Digital Communications", TMH, 2nd Edition 1983.
2. B.P.Lathi, "Modern Analog and Digital Communication", Oxford reprint, 3rd Edition, 2004.
3. Singh, Sapre, "Communication Systems Analog and Digital", TMH, 2nd Edition, 2004.

Web References:
1. http://www.igniteengineers.com 2. http://www.ocw.nthu.edu.tw 3. http://www.uotechnology.edu.iq
E-Text Books:
1. https://www.jntubook.com/dgital-communications-textbook 2. http://tradownload.com/results/neamen-digital-communications-.html 3. http://www.everythingvtu.wordpress.com